COMPARATIVE ANALYSIS OF DAMPED TRANSVERSAL VIBRATIONS OF A COLUMN WITH NON-HOMOGENOUS STIFFNESS FOR DIFFERENT CONSERVATIVE LOADING CASES

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The subject of this work is the natural vibrations of slender columns under a specific load. Such a column can model structures encountered in engineering or construction, including machine parts, bridge elements, or supporting structures. The system is characterized by a stepwise flexural stiffness.

The starting point for the load was a generalized load by a force directed towards the positive pole [1]. In the study, other conservative load cases were obtained by selecting the geometric parameters of the loading structure. The model accounts for the flexibility of structural nodes by attaching a rotational damper to the column end support. The work also considers the influence of the column's internal and external damping [2]. The problem was formulated based on the Bernoulli-Euler theory and then solved using the variational method. Determining the differential equations of motion of individual column segments and their solutions, taking into account boundary conditions, enabled the development of a transcendental equation that provides values for the vibration frequency.

The influence of different kinds of damping on the change in natural frequency was considered in detail. The first two vibration frequencies of the tested system and the reference system (without damping) were compared, under different external load directions and column geometries (variable cross-sections). Based on the presented results, the influence of damping on the system's dynamics was determined and identified as one method for controlling its dynamic properties.

References

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